

Structural Optimization of Shell and Arched Structures

Authors : Mitchell Gohnert, Ryan Bradley

Abstract : This paper reviews some fundamental concepts of structural optimization of shell structures, which is based on the type of materials used in construction and the shape of the structure. The first step of structural optimization is to break down all internal forces into fundamental principal stresses. The stress patterns direct our selection of structural shapes and the most appropriate type of construction material. In our selection of materials, it is essential to understand that all construction materials have flaws, or micro-cracks, which reduce the capacity of the material. Because of material defects, many construction materials perform significantly better when subjected to compressive forces. Structures are also more efficient if bending moments are eliminated; thus, it is essential to select natural structures, or structures where the natural flow of stress follows the axis of the shell. The shape of the structure, therefore, has a profound effect on stress levels. Stress may be reduced dramatically by simply changing the shape. Catenary, triangular and linear shapes are the fundamental structural forms to achieve optimal stress flow. If the natural flow of stress matches the shape of the structures, the most optimal shape is determined.

Keywords : arches, economy of stresses, material strength, optimization, shells

Conference Title : ICSESES 2022 : International Conference on Structural Engineering, Structural Elements and Systems

Conference Location : Venice, Italy

Conference Dates : August 16-17, 2022